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COMPUTER ABSTRACTS

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GENERAL

411 **Le Centre de Calcul "ANALAC".** ("ANALAC" Computation Centre). J. J. Gleitz, *Bull. Provisional Int. Computation Centre,* Jan. 1961, 14-18 (In French). Account of the equipment and activities of "ANALAC", an analogue computing centre established in Paris by C.S.F. 5 refs.

412 **Computers and the new technology.** D. E. Greene, *Automn. Progress,* **6,** Feb. 1961, 55-60, 64. Applications of digital computers in the field of production are reviewed. Main sections of the article deal with machine tool control, process control, production control and sequence control of the manufacture of discrete products. Other applications such as production line balancing and operational research are briefly examined. In conclusion, the economic and financial aspects of the industrial use of computers are discussed.

413 **Data processing and higher management.** R. W. Dayhuff, *Data Processing* (Detroit), **3,** Jan. 1961, 18-19. Some advice to data processing managers on how to deal with higher level managers.

414 **The experience of applying a commercial computer in a British organization.** A. J. Platt, *Computer J.,* **3,** Jan. 1961, 185-197. An account of the experience of Pilkington Brothers Limited (glass manufacturers) in installing and operating a digital computer. The feasiblity study is described and the selection and training of programmers is outlined. An account is then given of a pilot scheme for using a computer for production and stock control of a toughened glass high voltage insulator. The installation of an ICT 1201 and its later replacement by an ICT 1202 is summarised. The main application in sales procedure and other applications to payroll, expansion of the pilot scheme and production control of optical glass are discussed. Administration of the computer department and finance are considered and finally the future effect of computers on business organisation is examined. 3 refs.

415 **General problems confronting computing centers.** R. Courant, *Bull. Provisional Int. Computation Centre,* Jan. 1961, 10-13. Some remarks on the need for a broader acceptance and use of digital computers by scientists and technologists and for an academic rather than commercial mode of operation of computing centres.

416 **List of literature on mathematical computation problems for 1958.** *Automatika i Telemakhanika,* **21,** 1960, 1629-1652 (In Russian). Classified bibliography containing some 500 Russian and other references.

417 **Objective aspects of computer facility design.** R. P. Larsen, *J. Industrial Engng.,* **11,** July-Aug. 1960, 328-331. This paper attempts to formulate objective criteria to assist in resolving perplexities inherent in the facility cost analysis and system layout phases of computer facility design.

418 **The path ahead for computing.** F. D. Thompson, *Datamation,* **7,** Jan. 1961, 8. Brief introduction to four articles (abstracted below in Refs. 419 to 422) dealing with present and future trends in the areas of personnel, programming, hardware and applications.

419 **The human side of computing.** D. D. McCracken, *Datamation,* **7,** Jan. 1961, 9-10. Discusses the training of the large numbers of programmers and other personnel required now and in the future and their "professional recognition".

420 **Trends in computer hardware.** G. Jones, *Datamation,* **7,** Jan. 1961, 11-12. Some remarks on possible future improvements in speed, reliability, economy and communication facilities for direct input-output.

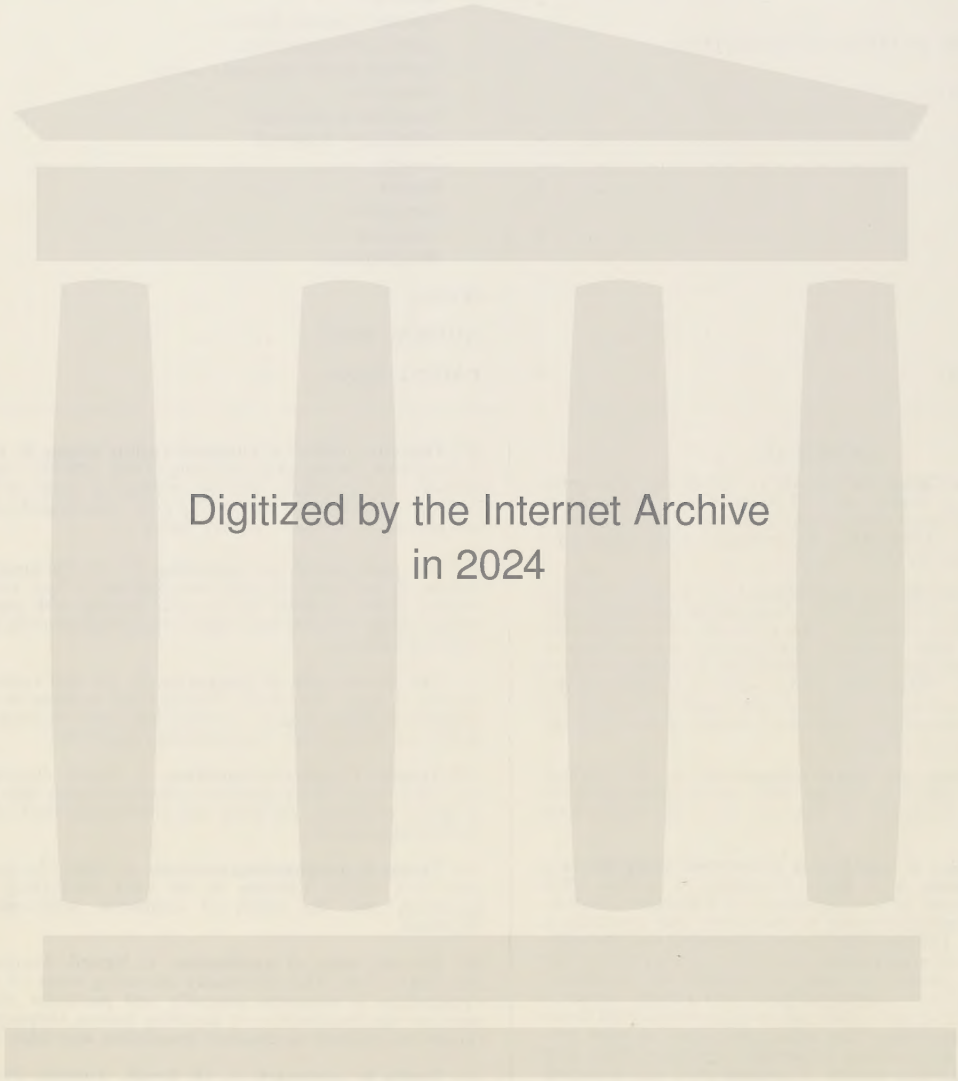
421 **Trends in programming concepts.** A. Opler, *Datamation,* **7,** Jan. 1961, 13-14. Changes in the work undertaken by programmers and the status of automatic programming are discussed.

422 **On new areas of application.** A. Newell, *Datamation,* **7,** Jan. 1961, 15-16. The continually increasing range of computer applications is discussed generally and particular mention is made of the possibilities of handling human language for information retrieval, mechanical translation and other purposes.

423 **Russia in retrospect.** A. D. Booth, *Automn. Progress,* **6,** Jan. 1961, 18-20. Discusses the Russian computers BESM I, STRELA and URAL, their research and machine translation.

424 **Training personnel.** V. J. Bronsing, *Data Processing* (Detroit), **3,** Jan. 1961, 22-23. General account of a Data Processing Institute which trains operators for data processing systems.

425 **An introduction to digital computing.** B. F. Green, M.I.T., *PB 171100,* 18 Aug. 1960, 46 p. This report provides an introductory description of digital computers and a preliminary guide to programming. It also briefly surveys the uses psychologists have found for computers and lists some of the practical issues involved in using computers. 111 refs.



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DESIGN

426 **Binary multiplier.** J. L. Sanborn, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 59-60. Description of a circuit capable of performing binary multiplication with a three-bit multiplier and a three-bit multiplicand. Shift registers are combined with a three-bit parallel adder all using cryotrons as switching elements.

427 **Boolean functions realizable with single threshold devices.** M. C. Paull and E. J. McCluskey, *Proc. IRE,* **48,** July 1960, 1335-1337. Letter discussing the properties of the Boolean functions which can be realized with a single threshold device, such as a magnetic core.

428 **Charge transfer logic.** R. W. Landauer, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 52-54. Description of logic employing ferroelectric capacitors between which data-representing charges are transferred in accordance with desired logical functions.

429 **Computers as an aid in computer design assessment.** J. M. Bennett and R. J. Dakin, *Computer J.*, **3,** Jan. 1961, 253-255. A simulation routine was written so that code checking could be done on SILLIAC for SNOCOM, a small magnetic drum computer being tested at Sydney University for the Snowy Mountains Hydroelectric Authority. The routine could print out, at any stage of the execution of a program, details of timing and it was thus possible to investigate the effect of modifying the order code in various ways and of changing the overall organisation of SNOCOM. In this paper, SNOCOM, SILLIAC and the simulation routine are briefly described and the application to computer design assessment is discussed. 3 refs.

430 **Cryogenic circuits.** J. L. Sanborn, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 57-58. Description of five circuits each employing 12 cryotrons for performing binary arithmetic. Three of the circuits are full binary subtractors and the other two are full binary adders.

431 **Determination of maximum error of binary multiplier.** Y. Si-Zen, *Automatika i Telemekhanika,* **21,** 1960, 1007-1014 (In Russian). English abstract: "Digital integrator based on a binary multiplier is considered. Its errors due to fluctuation of frequency of output pulses are analysed. The formula for maximum value of the error is deduced." 4 refs.

432 **Digital comparison by NOR logic.** J. M. Boswell, *Instr. & Control Systems,* **34,** Jan. 1961, 62-63. Brief account, with logic charts and block diagrams, of comparator circuits, showing that only two NOR elements are required to make an inequality comparison of two bits and only four for an equality comparison.

433 **Multipath magnetic core transistor translator.** N. F. Lockhart and R. M. Tomasulo, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 47-48. Description of a translator which receives binary coded decimal signals and converts them to signals in a one out of ten code. Multipath magnetic cores interconnected by transistor circuits are employed.

434 **Optimum load for Esaki diode bistable multivibrator.** C. Lanza, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 24-25. The optimum load for Esaki diode bistable multivibrators is analysed.

435 **Sensing circuit for bistable storage device.** C. Lumpkin, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 49-50. Circuit for a binary storage device which enables the device to be sensed in three different ways according to which one of three lines is pulsed. The device can be sensed for a "1" condition without destroying the stored information, or it can be sensed for a "0" and left in the "1" condition, or it can be sensed for a "1" and left in the "0" condition.

436 **Development of a majority gate for improving digital system reliability.** R. Wasserman, Hermes Electronics Co., *PB 150484,* 2 Nov. 1959, 51 p. Efforts have been made to develop logical design procedures for the efficient use of redundancy in improving the reliability of digital systems. This requires a highly reliable, simply constructed, majority gate. Requirements and design considerations are presented for the majority gate using magnetic cores as logical building blocks. Logical design principles are presented for shift register, dynamic flip-flop, logical gate functions, binary counter, comparator and two input full adder. The 6-core majority gate module and 9-core majority gate module are discussed.

437 **Preliminary study of the probabilistic behavior of a digital network majority decision elements.** S. Muroga, Rome Air Development Center, *PB 150973,* Aug. 1960, 15 p. This report discusses the probabilistic behaviour of a network of elements characterised by a majority decision principle. 1 ref.

438 **Studies in partial switching of ferrite cores.** R. H. Tancrell and R. E. McMahon, M.I.T., *PB 149773,* 21 Sept. 1959, 19 p. This report concerns a study of the characteristics of Mg Mn ferrite cores in various partially switched states. The switching characteristics of cores under driving conditions of high and low amplitude currents of different widths are presented. A detailed discussion is given of the impulse switching mode of core operation to achieve increased memory speed. Additional results are presented for special cores fabricated with different geometries. It is found that the amplitude and width of the partial-switching current has a pronounced effect on the core's behaviour to subsequent drive pulses. Only an inner ring of a core is switched by a low amplitude current. With a high narrow current, flux is switched to a varying degree from the inside to the outside diameters. 9 refs.

439 **Testing continuous computers.** R. C. Mikulich, University of Chicago, *PB 171080,* Feb. 1958, 208 p. This report is concerned with the design and development of performance tests for continuous computers. A mathematical theory of testing continuous computers is given and the differences between component and system testing are delineated. 18 refs.

440 **Transistor life in the TX-O computer after 10,000 hours of operation.** D. J. Eckl and R. L. Burke, M.I.T., *PB 150601,* 14 April 1960, 47 p. The TX-O computer is a 5Mc/s machine employing 2600 type L-5122 surface-barrier transistors in its high speed central section. After some 6000 hours of operation, 678 surface barrier transistors, 58 microalloy transistors and 108 grown-junction transistors were removed for retest. The previously reported results of this examination are repeated in the present report. In 1958, a 64×64 word transistor-driven magnetic core memory was substituted for a larger vacuum tube-driven memory. In July, 1959, when the transistors had reached a total operating time of about 10,000 hours, the 58 microalloy transistors and 800 surface-barrier transistors were removed for retest, the results of which are presented in this report. During the entire period of operation, only one transistor—a light pen amplifier—was removed as an "uncaused" failure. Approximately 10 per cent of the transistors tested fell below original acceptance specifications, but they were returned to service and have operated normally.

441 **Control circuitry for a magnetic core matrix.** Electric & Musical Industries Ltd., *B.P. 858116,* 4 Jan. 1961. A transistor switching circuit suitable for a magnetic core matrix control circuit, comprises a load connected between electrodes, which conduct in the same direction, of two transistors, and means for selectively rendering the transistors conducting.

442 **Back-recording system for magnetic core matrix.** Philips Electrical Industries Ltd., *B.P. 858260,* 11 Jan. 1961. This patent is concerned with a magnetic core matrix provided with arrangements for back-recording of data subsequent to its readout. Operating speed is increased by providing between each reading conductor and the related amplifier a gate which is blocked during the back-recording.

443 **Switching circuitry for a magnetic core matrix.** Electric & Musical Industries Ltd., *B.P. 858278,* 11 Jan. 1961. A switching circuit which preferably employs a transistor, is designed to provide currents of predetermined values for supply to the windings of a magnetic core matrix.

444 **Switching circuitry for a magnetic core matrix.** Electric & Musical Industries Ltd., *B.P. 859043 & 859045,* 18 Jan. 1961. These two patents are concerned with switching circuits designed in particular for magnetic core matrices. According to *B.P. 859043,* a current is switched through a load connected in series with a ballast impedance across a potential source, by connecting the load in parallel with a transistor current path. According to *B.P. 859045,* the current flow through a load is reversed by a circuit including two transistors or thermionic valves rendered alternately conducting.

445 **Storage matrix for microprogramming.** Electric & Musical Industries Ltd., *B.P. 859846,* 25 Jan. 1961. A data storage matrix is provided with arrangements whereby data from a particular row or rows can be transferred only to a particular destination, such a system being suitable for microprogramming purposes.

446 **Magnetic core store.** Electric & Musical Industries Ltd., *B.P. 859944,* 25 Jan. 1961. This patent concerns a magnetic core store in which a current waveform applied to a core is compared with a standard waveform, and an error signal is derived and used to counteract departure of the applied waveform from the standard.

447 **Control of a magnetic core data storage matrix.** Telemeter Magnetics Inc., *U.S.P. 2948885,* 9 Aug. 1960. This patent is concerned with a magnetic core matrix from which data is read in the same sequence as it was written, and describes an arrangement employing a further control matrix of magnetic cores for establishing the condition of a storage location.

448 **Arithmetic unit.** Sperry Rand Corp., *U.S.P. 2949230,* 16 Aug. 1960. This patent is concerned with parallel binary arithmetic units and with an adder unit for use in such arithmetic units, the adder unit including an accumulator which employs magnetic cores and in which a carry is propagated through electrically passive elements so as to reduce the carry propagation time.

449 **Arithmetic unit.** Westinghouse Electric Corp., *U.S.P. 2949231,* 16 Aug. 1960. In an arithmetic unit for floating radix notation, a comparator employing diode or other matrices is provided to compare the relative magnitude of two values prior to addition or subtraction.

450 **Electrostatic data storage.** Int. Business Machines Corp., *U.S.P. 2950465,* 23 Aug. 1960. Detailed description of an electrostatic data storage system employing cathode ray tubes and its use in a data processor.

451 **Error correction system.** Bell Telephone Labs., Inc., *U.S.P. 2951229,* 30 Aug. 1960. Two monitors are coupled to switched-current non-return-to-zero signal sources; one monitor detects a parity failure in a simultaneously-presented signal group, the other detects a transition failure between sequentially-presented signal groups. The correct value of the group is ascertained by means for correlating the parity and transition failures.

See also :—
General, Ref. 417.
Elements, Ref. 521, 525.
Applications: Electronics, Ref. 594.

LEARNING AND PATTERN RECOGNITION

452 **Equivalent transformations of sequence machines.** A. S. Blokh, *Automatika i Telemekhanika,* **21,** 1960, 1490-1496 (In Russian). English abstract: "There are determined some equivalent transformations and sequence machines of the corresponding structure." 3 refs.

453 **A note on a pattern recognition scheme.** A. Gill, *Proc. IRE,* **48,** Nov. 1960, 1912. Letter referring to "Pattern detection and recognition," S. H. Unger, *ibid,* **47,** Oct. 1959, 1737-1752 (*C.B.,* **3,** Nov./Dec. 1959, Ref. 2565) and presenting bounds to the number of two-dimensional properties for the unique association of each pattern with a set of such properties. 2 refs.

454 **Optical character recognition.** W. S. Carter, *Data Processing* (Detroit), **3,** Jan. 1961, 7-10. Discusses the need for character recognition machines, the character recognition process generally, design philosophy of character recognition machines, the magnetic ink character recognition system adopted by the American Banking Association, and present limitations and future possibilities.

455 **Optical scanning equipment.** J. H. DeJong, *Data Processing* (Detroit), **3,** Jan. 1961, 11-12. Brief survey of commercial equipment for optical scanning of characters and of applications for such equipment.

456 **On realization methods for finite automaton which time pace is defined by change of input state.** M. A. Aizerman, L. A. Gusev, L. I. Rozonoer, I. M. Smirnova and A. A. Tal, *Automatika i Telemekhanika,* **21,** 1960, 1576-1594 (In Russian). English abstract: "There are considered three methods of realization, which are economic from the viewpoint of number of states, of a finite automaton set by an equation (or table) and operating in a time pace regime caused by change of the input states of the automaton. The methods are distinguished by an amount of information which defines the automaton input. The first method (Huffman method) intends minimum information, i.e. information on input state at the moment only; the second method supposes introduction into the automaton of additional information on moments of changing input state; the third method intends introduction into the automaton of information on input state at the moment and at some preceding moment of time. It is shown that one can get the most economic automaton using the third method." 7 refs.

457 **Self-perfecting cybernetic control systems are able to learn.** A. G. Ivakhnenko, *Automatika,* 1959, No. 4, 1-24 (In Russian). English abstract: "Learning ability differs in various cybernetic control systems. Six properties of learning systems are formulated. Determined systems have only two of them. Probability statistical systems have a more complicated learning process. Systems of universal action—particularly homeostats and so-called 'biological systems'—have most developed learning. Further development of learning systems is not limited. Schemes and a classification of learning systems are given. It is established that learning systems may be developed on two diverse principles: open link control by 'disturbances' (inductive method); or closed loop control with feedback (deductive method). The most perfect systems are those combining both principles. The invariantness conditions for learning systems are deduced." 12 refs.

458 **Some design problems of machine classifying elements according to signs unknown beforehand.** E. M. Braverman, *Automatika i Telemekhanika,* **21,** 1960, 1375-1386 (In Russian). English abstract: "Some problems are considered relating to machines which are able to classify elements according to signs unknown beforehand. There is pointed out a number of general conditions when the problem can be solved by machines with stimulation (i.e. machines which get some additional information from the operator). It is shown that sometimes machines without stimulation can be used for the same purpose. Possibilities of an already realised machine of the kind (perceptron) are briefly discussed." 2 refs.

459 **A 6-symbol 7-state universal Turing machine.** M. Minsky, M.I.T., *PB 150508,* 17 Aug. 1960, 8 p. 4 refs.

460 **Contributions to perceptron theory.** R. D. Joseph, Cornell Aeronautical Laboratory Inc., *PB 171093,* 15 June 1960, 108 p. There are several ways in which an analysis of a perceptron's ability to associate responses with stimuli may proceed. One approach is to place a distribution over the members of a subclass and then to analyse statistically the ability of a randomly chosen member of the subclass to perform a given task. A second approach considers the "optimum" characteristics for the components for perceptrons subject to a given set of constraints and "optimum" operating procedures for given subclasses of perceptrons. Previously almost all analytic work has followed the first approach but recently some powerful results for the second approach have been obtained for a subclass of perceptrons called simple perceptrons. This report presents the rigorous analyses of the first type which have been obtained, displays the techniques which have thus far proved useful and gives some additional results of the second type. 6 refs.

461 **Tables of Q-functions for two perceptron models.** F. Rosenblatt, Cornell Aeronautical Laboratory Inc., *PB 171092,* May 1960, 144 p. This report contains four sets of tables for Q-functions. These functions have been found to be essential in many quantitative analyses of perceptrons and may be of more general interest since they include cumulative probability distributions for differences of binomial and Poisson distributed random variables. 4 refs.

462 **Character recognition.** Standard Telephones & Cables Ltd., *B.P. 858374,* 11 Jan. 1961. In character recognition equipment which employs a resistance matrix, connections are made from the intersection points of the matrix to magnetic core switching circuits.

463 **Character recognition.** IBM Deutschland Int. Buro-Masch. G.m.b.H., *G.P. 1095567,* 22 Dec. 1960. This patent describes character recognition apparatus employing a light spot scanning device which scans in succession several rasters with different line inclinations.

464 **Pattern recognition.** Laboratory for Electronics Inc., *U.S.P. 2947971,* 2 Aug. 1960. An unknown signal waveform, such as is derived from scanning a printed character, is identified by comparing portions of it with corresponding portions of several known waveforms.

See also :—
Techniques, Ref. 479.
Applications: Control—General Systems, Ref. 585.

MATHEMATICS

465 **Convergence properties of Gaussian quadrature formulae.** W. Barrett, *Computer J.*, **3**, Jan. 1961, 272-277. When using Gaussian quadrature formulae improved accuracy is usually sought by using formulae with an increasing number of points and the problem then arises with regard to error estimation that the rate of convergence of the process depends very materially on the nature of the integrand. In this paper an expression is found for the remainder of any Gaussian quadrature formulae as a contour integral and is then used to obtain estimates of the error in certain cases. Numerical examples are given comparing the actual and estimated errors. A method of constructing more general quadrature formulae is described and two examples are given of formulae so constructed. 2 refs.

466 **On existence, uniqueness, and numerical evaluation of solutions of ordinary and hyperbolic differential equations.** J. B. Diaz, University of Maryland, *PB 150641*, Sept. 1960, 31 p. Detailed account of a lecture delivered at the Sixth Conference of Arsenal Mathematicians held at Duke University, 1-2 June 1960. 22 refs.

467 **Numerical evaluation of certain infinite integrals.** S. R. Boley, Columbia University, *PB 150993*, Oct. 1959, 9 p. A modification for the usual asymptotic series expansion is presented. 4 refs.

468 **On the numerical evaluation of a class of multivariate normal integrals.** H. Ruben, Columbia University, *PB 152100*, 1959, 14 p. An explicit formula is obtained for the probability that each of n normally distributed and equally correlated random variables with zero expectations and unit variances does not fall short of a given value h. The ratio of the required probability to the density at the cut-off point is expressed as a power series expansion in $[n/(1+(n\text{-}1)\ \rho)]^{\frac{1}{2}}h$, where ρ is the common correlation. The coefficients in the expansion involve the geometrical moments relative to the plane of symmetry Λ of a regular $(n\text{-}1)$ dimensional spherical simplex, with dihedral angles arc cos ρ, Λ being defined as that plane through the centre of the hypersphere (on whose surface the simplex is located) which is orthogonal to the line joining the latter point and the centroid of the simplex. 10 refs.

469 **Numerical quadrature over a rectangular domain in two or more dimensions III. Quadrature of a harmonic integrand.** J. C. P. Miller, University of Illinois, *PB 152109*, 11 Dec. 1959, 12 p. This report appears to be the same as the paper appearing in *Maths. of Computation*, **14**, July 1960, 240-248 (*C.A.*, **4**, Sept. 1960, Ref. 1673).

470 **Numerical values of some integrals involving Bessel functions.** D. L. George, Duke University, *PB 152066*, July 1960, 29 p. The object of this paper is to make available tables of numerical values of the integrals $S(\nu,n)$, $C(\nu,n)$ for the values:—

$$\nu=0,\ n=0,1;$$
$$\nu=1,\ n=1,0,1.$$

Analytical expressions for these integrals are derived. 4 refs.

TECHNIQUES

471 **A comparison of some methods of calculating covariance functions on an electronic computer.** I. J. Good, *Computer J.*, **3**, Jan. 1961, 262-265. This paper is concerned with a problem which may be stated as follows: Let $a_1,a_2,\ldots a_N$; $b_1,b_2,\ldots b_N$ be $2N$ numbers, each of at most ν binary digits. It is desired to calculate the $2M+1$ "lagged products"

$$c_s = \sum_{r=1}^{N-s} a_r b_{r+s} \quad (s = -M,\ -M+1,\ \ldots,\ M),$$

for some $M \ll N\text{-}1$. It is assumed that N is large, and M not too small, and that ν is considerably smaller than the word length of the computer. Three methods of organising the calculation, in each of which several numbers are packed into a single word, are compared. 3 refs.

472 **Considerations in choosing a character code for computers and punched tapes.** H. McG. Ross, *Computer J.*, **3**, Jan. 1961, 202-210. This paper describes work initially concerned with establishing the most satisfactory code to be used within the Ferranti Orion and Atlas systems and codes for punched paper tapes and magnetic tapes, but which has resulted in a scheme of more extensive application. The considerations affecting the choice of a code for alphanumeric characters are discussed, the primary aim being to assist processing of commercial data in a computer system. A basic 6-bit code is obtained from which 7- and 8-track punched tape codes are derived. The realization of minor variants of these codes on existing data preparing and printing equipment is described. Future extensions of the scheme are considered. 9 refs.

473 **An introduction to analogue computer methods.** J. G. Thomason, *Computer J.*, **3**, Jan. 1961, 211-219. The general purpose analogue computer and its basic units are described. An example of an analogue computer set-up is given for a simple problem concerned with liquid level in an irregular-shaped tank with inlet and outlet. Applications of the analogue computer to system dynamics studies, system simulators for training purposes, economics and operations research are discussed. 50 refs.

474 **An iterative method of numerical differentiation.** D. B. Hunter, *Computer J.*, **3**, Jan. 1961, 270-271. After reviewing Aitken's and Neville's methods for iterative interpolation, this paper describes a method, similar to those methods, for estimating the derivative of a function defined by a table of values. The method can be used with either equally-spaced or unequally-spaced ordinates. 2 refs.

475 **A least squares surface fitting program.** J. H. Cadwell, *Computer J.*, **3**, Jan. 1961, 266-269. This paper describes a Mercury Autocode program which fits a function $f(x,y)$ to values of a variable z specified at points of a rectangular grid in the (x,y) plane. It uses the method of orthogonal polynomials, providing a detailed guide as to which polynomial terms need be included. 5 refs.

476 **Optimum time for multiplication on a digital computer.** H. H. Johnson, *Computer J.*, **3**, Jan. 1961, 256-261. Methods of multiplication used on serial binary computers are discussed with reference to the optimum time required on a machine with a cyclic main store. From this point of view the methods are shown to be of four main types and the time to be allowed for multiplication in optimum programming is calculated in a number of cases. The possible time saving of reversing the multiplier and multiplicand is also considered. 8 refs.

477 **Random sampling from the normal distribution.** J. C. Butcher, *Computer J.*, **3**, Jan. 1961, 251-253. The normal distribution is frequently encountered in Monte Carlo calculations and it is important therefore that a rapid means be available for sampling from this distribution in a computer. This paper describes two simple, fast methods, one being particularly simple and the other particularly fast. 2 refs.

478 **Trigonometric method for conformal mapping with algebraic polynomials by the use of a repetitive differential analyser.** J. Petrich, *Ann. Assn. Int. Calcul Analogique*, **3**, Jan. 1961, 11-17. This paper describes conformal mapping with algebraic polynomials using a repetitive differential analyser. Particular attention is given to the problem of the stability of the feedback system. The determination of real and complex zeros of algebraic polynomials is treated as a special case of conformal mapping. 13 refs.

479 **Design and operation of digital calculating machinery.** H. Aiken, Harvard University, *PB 148259*, 1 Dec. 1959, 123 p. Contents: Pattern recognition using correlation; Some aids to the evaluation of a certain integral; Beam sweep matrix computations; Aerodynamic origin of magnus moment.

480 **A method for solution of nonlinear network problems by digital computers.** W. F. Gillmore, Stanford University, *PB 152183*, 30 Dec. 1959, 183 p. Contents: The evolution of the approximation method—Prony's method, Tuttle's method, Alternate procedures; Calculation by continued fractions—Expansion of a series in a continued fraction, Converting continued fractions to ordinary fractions, Simple approximations, A complete table of approximations, Questions of convergence; Relation to Hilbert space theory—Two special continued fractions, A releated linear operator, Eigenfunctions of the linear operator, Inversion of the Stieltjes transform; Approximate solution of nonlinear differential equations—Nature of the aproximation, Calculation of the initial derivatives; Other applications and examples—Digital computer programming, Network synthesis from time response, Analog computer function generators, Approximations from discrete data. 25 refs.

481 **Minimization of Boolean functions.** Remington Rand Univac Division, Sperry Rand Corp., *PB 152049*, April 1960, 47 p. This report describes and compares two methods of reducing a Boolean function to simplest normal form by a computer. The two methods are Quine's method for obtaining the "prime implicants" and Urbano and Mueller's topological method for determining the "essential stars". The feasibility of programming these methods for the Air Force Cambridge computer is investigated and several possible programs evaluated. Five programs were developed which handle both methods and extensions of these programs to handle more terms or more variables or both were evaluated. The running times of the two methods are compared and the possibility of using criteria other than running time for comparison is investigated. 6 refs.

See also :—
Applications: Electronics Ref. 594, **Physics** Ref. 603. **Miscellaneous** Ref. 615.

ACCESSORIES

482 **Data compression system.** R. W. Bemer, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 8-9. Description of a data transmission system in which data words in a high-redundancy message code are converted for transmission over a long line into a minimum-redundancy compressed transmission code.

483 **Digital data recording equipment.** *Automn. Progress*, **6,** Jan. 1961, 16-18. Description of the magnetic data recording system employing an intermittently moved tape, which is primarily intended for use with the RADIC (Redifon Analogue-Digital Computing) System. This article is substantially the same, with minor additions, as that appearing in *Instrument Practice*, **14,** Dec. 1960, 1303-1304 (*C.A.*, **5,** Feb. 1961. Ref. 282).

484 **High speed printer.** A. M. Gindi, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 42-43. Hammer driven coils in a fast printer must be driven for a period exceeding one machine cycle. Since each hammer driver is selected for setting or resetting once per machine cycle, it is necessary to prevent premature resetting of selected hammer drivers. Arrangements for this purpose are described.

485 **Message routing and control using end of message character.** R. A. Jensen and P. P. Cartier, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 12-14. Description of how in a data transmission system any one of several end-of-message characters is used to indicate termination of a message and each end-of-message character establishes different message routing and control functions.

486 **Perf-O-Data, a legible perforated code.** *Data Processing* (London), **3,** Jan.-March 1961, 2-9. Account of Perf-O-Data code and equipment introduced by Cummins-Chicago Corporation. The essential feature is the use of a code whereby holes are punched in a pattern similar to the normal printed outline of the standard arabic numerals so that the code can be read by men and machines.

487 **Positive blank column indicator.** W. L. Stahl, *IBM Technical Disclosure Bull.*, **3,** Jan. 1961, 6-7. In computer practice a definite symbol is assigned to indicate a blank or unpunched column of an IBM card. A description is given of an improved photoelectric arrangement for scanning cards or other punched media in which an unpunched column is indicated.

488 **Remote electronic data processing—past, present, and future—some remarks.** M. M. Astrahan, *Computers & Automn.*, **10,** Jan. 1961, 6, 8. Brief account of the development and present and future applications of data transmission systems with particular reference to IBM systems.

489 **Systems talk through common-language pool.** W. Ellis, G. R. Justus and W. D. Bell, *Control Engng.*, **8,** Feb. 1961, 135-138. Description of PICE (Programmable Integrated Control Equipment), a system developed by Lockheed and Beckman for real-time control of a large number of different data equipments which is being installed at two U.S. Air Force data centres. In these installations PICE will integrate high speed data links, low speed teletype links, tape transports, radio telemetry links, large high speed digital computers, various operating consoles, R.F. command transmission links, tracking equipment, a timing system, analogue displays, digital displays, plotting boards and other equipment. The PICE system concept uses a high sampling speed and stored program access to a common-language information pool memory to integrate all these asynchronous, multi-language instruments. It is claimed that the system is widely applicable in business and industry as well as to satellite control.

490 **Tape systems error correction.** J. P. Hart and J. P. MacDougall, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 10-11. Description of a method of double recording on tape in which a true character is first written and then the complement of that character is written. On reading the true character a vertical redundancy check is performed and if an error is found, the true character is reconstructed from the read complement.

491 **Terminology for functional characteristics of analog-to-digital converters.** W. M. Gaines and P. P. Fischer, *Control Engng.*, **8,** Feb. 1961, 97-98. Recommended terminology for functional characteristics of analogue-to-digital converters by members of the Component Specifications Subcommittee of the AIEE Feedback Control Systems Committee. 3 refs.

492 **Unique plotting system turns digits into curves.** M. Bain and R. N. Flanders, *Control Engng.*, **8,** Jan. 1961, 111-114. Description of Moseley Type 575 system for continuous curve plotting on X-Y or strip charts under control of a special format magnetic tape written by general purpose computer subroutines. 2 refs.

493 **What's available for digital data transmission.** R. F. Shaw, *Control Engng.*, **8,** Feb. 1961, 127-133. Some of the principal problems of data transmission that affect transmission equipment are outlined and the available equipment for use with leased wire lines and toll exchange networks is surveyed. Details of the equipment of 13 manufacturers are tabulated as to modulation technique, recording medium, error check technique and data rate. Only equipment for use with telegraph and voice-grade lines is covered.

494 **The calliscope: a versatile alphanumeric display.** K. E. Perry and E. J. Aho, M.I.T., *PB 150598*, 13 Nov. 1959, 18 p. The calliscope is a digitally controlled alphanumeric and graph display intended for presentation of output data from a digital computer. This display employs a magnetically focused and deflected cathode ray tube. Spot positioning is accomplished by digital switching of high currents through a low inductance yoke. Settling time is 20 microseconds. Alphanumeric symbols are generated by a calligraphic or spot writing method which synthesises the X and Y current waveforms necessary to control the motion of the spot. 1 ref.

495 **Computer power supply control.** Int. Business Machines Corp., *B.P. 857622*, 4 Jan. 1961. This patent is concerned with a switch for sequentially connecting circuits of a computer to their respective voltage supply units and disconnecting them in reverse order if a fault occurs in a circuit or supply unit.

496 **Reading magnetic data records.** Standard Telephones & Cables Ltd., *B.P. 857955*, 4 Jan. 1961. In the reading of magnetic data records, a data pulse is applied to the input of clock pulse generating equipment and after being delayed by half its period, it starts the clock pulse generator which is stopped by the application of another data pulse to the input.

497 **Magnetic data recording system.** Olympia Werke A.-G., *B.P. 857977*, 4 Jan. 1961. In a magnetic recording system employing the return-to-zero method, an input AND circuit is supplied with word pulses to be recorded and with synchronising pulses of shorter duration than clock pulses and occurring at the middle of each clock pulse.

498 **Data transmission.** Sperry Rand Corp., *B.P. 858212*, 11 Jan. 1961. Transmission errors are detected and suppressed by means of an error detecting circuit which produces, in response to an apparent error in a quantum of data signals, a gating signal, the error detecting circuit being coupled to a processing circuit for modifying the strength of the signals. The quantum of data signals is resubmitted a given number of times to the error detecting and processing circuits and transmission is terminated for genuine errors but not for non-continuing errors by means of a network controlled by the gating signals and the processing circuit.

499 **Printer.** Int. Business Machines Corp., *B.P. 858410*, 11 Jan. 1961. In a printer particularly intended for use with a data processor, type faces are carried by an endless moving band and actuation of print hammers is controlled by signal-producing means synchronised with the movement of the band.

500 **Magnetic tape recording.** G. Dirks, *B.P. 858766*, 18 Jan. 1961. Data is recorded on magnetic tape by moving the tape lengthwise intermittently and reciprocating a magnetic head across the tape at an angle to the direction of tape movement so as to record the data in parallel tracks.

501 **Display or printing of digital computer output.** Bailey Meters & Controls Ltd., *B.P. 859914,* 25 Jan. 1961. In apparatus for displaying or printing the decimal output of a digital computer, indication of which one of a group of conductors is instantaneously electrically distinguished from the remainder is effected by means of a rotatable member carrying indicia corresponding to the conductors.

502 **Tape feed.** Int. Computers & Tabulators Ltd., *B.P. 859923,* 25 Jan. 1961. Apparatus for feeding magnetic or other tape includes a reservoir for a loop of tape which is drawn into two channels by means of a source of negative air pressure.

503 **Magnetic drum system.** Siemens & Halske A.-G., *G.P. 1094022,* 1 Dec. 1960. Writing and reading of data on a magnetic drum is effected with groups of magnetic heads connected to common amplifiers.

504 **Erasure of magnetic records.** IBM Deutschland Int. Buro-Masch. G.m.b.H., *G.P. 1094476,* 8 Dec. 1960. A direct or alternating magnetic field is employed for erasing data recorded magnetically on an endless tape or drum.

505 **Mounting of magnetic drum heads.** Standard Elektrik Lorenz A.-G., *G.P. 1095014,* 15 Dec. 1960. Heads for a magnetic drum are held in pairs by means of leaf springs in apertures provided in a cylindrical carrier.

506 **Computer readout device.** American Bosch Arma Corp., *U.S.P. 2947911,* 2 Aug. 1960. Arrangements for controlling banks of glow discharge tubes, neon lamps for example, so that a number of readouts can be obtained from a single counting chain.

507 **Punched record reader.** Curtiss-Wright Corp., *U.S.P. 2949226,* 16 Aug. 1960. This patent is concerned with a capacitive or other type of reader for an erasable and re-usable punched record which is composed of metallic or other malleable material and has slits therein so that selected flap portions may be bent out of the plane of the record to provide holes and bent back again to close the holes.

508 **Analogue-to-digital converter.** Int. Business Machines Corp., *U.S.P. 2949602,* 16 Aug. 1960. An analogue-to-digital converter comprises a closed superconductive loop including a hard superconductor and a soft superconductor, and the varying input signal is supplied to magnetic field producing means which includes a hard superconductor inductively coupled to the hard superconductor in the loop.

509 **Analogue-to-digital converter.** Int. Business Machines Corp., *U.S.P. 2950052,* 23 Aug. 1960. An analogue-to-digital conversion system employs capacitor switching in the precise integration of an analogue voltage to produce a pulse output which represents the time integral of the analogue voltage.

510 **Analogue-to-digital converter.** Minneapolis - Honeywell Regulator Co., *U.S.P. 2950469,* 23 Aug. 1960. An analogue-to-digital converter employs quantizer stages each comprising rectifier means and a cathode follower, the first stage being supplied with the input voltage and a standard voltage, each subsequent stage with the output of the preceding stage and a different standard voltage.

511 **Buffer store.** Radio Corp. of America, *U.S.P. 2951233,* 30 Aug. 1960. In a buffer store for transferring data between data handling devices operating at different speeds, one of the operations of write-in and read-out for a shift register is effected at a fixed address while the other operation is effected at a shifting address.

ELEMENTS

512 **Bidirectional counter.** L. J. Rosenberg, *IBM Technical Disclosures Bull.,* **3,** Jan. 1961, 17-18. Description of a binary coded decimal counter in which the count is increased or reduced according to which of two lines pulses are applied.

513 **Card capacitor—A semipermanent, read only memory.** H. R. Foglia, W. L. McDermid and H. E. Petersen, *IBM J. Res. & Dev.,* **5,** Jan. 1961, 67-68. Letter describing a semipermanent read only memory called the Card Capacitor. It consists of groups of two printed circuit boards with parallel conductors on each arranged so that when they are placed facing each other, the crossings between orthogonal pairs of conductors correspond to the 960 possible hole positions in the IBM record card. Data to be stored is punched on a metallised IBM card, a hole representing one and no hole representing zero. The card is inserted between the two printed circuit boards. Row or column may be defined as word and during readout a voltage pulse is applied to a selected word conductor. Where there is a hole this voltage will be capacitively coupled through the hole to one of the sense conductors. 1 ref.

514 **Comparator using Esaki diode.** W. K. French, *IBM Technical Disclosures Bull.,* **3,** Jan. 1961, 26. Brief description of an Esaki diode circuit for comparing two voltages.

515 **Digit device elements of computation based on principle of integrating voltage pulses.** E. K. Yuferova, *Automatika i Telemekhanika,* **21,** 1960, 1165-1172 (In Russian). English abstract: "There are considered two types of digit device elements of computation based on the principle of integrating voltage pulses." 3 refs.

516 **A diode generator of functions of two variables.** M. Petternella and A. Ruberti, *Ann. Assn. Int. Calcul Analogique,* **3,** Jan. 1961, 18-24. This paper presents a diode generator of functions of two independent variables. Linear functions of the two variables are generated by means of passive networks and are selected by means of diodes. The circuit used for the passive networks is described; it enables the function to be preset by three consecutive operations which do not interfere with each other. Selection circuits are then considered in relation to the class of function generated. Some constructional details of the prototype and two methods of presetting are described. 3 refs.

517 **ELPC direct readin memory drum.** R. Rice and R. I. Roth, *IBM Technical Disclosures Bull.,* **3,** Jan. 1961, 55-56. Description of a computer memory into which punched tape is read directly without any intermediate circuitry. The memory comprises a rotatable drum with electroluminescent photoconductor (ELPC) latches on its surface. These latches once illuminated remain active, i.e. emit light, until their power supply is cut off. A punched tape is indexed over a selected portion of the drum and a light source turned on to activate those latches beneath holes in the tape. Readout is effected with photocells.

518 **Esaki diodes using boron-doped germanium.** J. C. Marinace, *IBM Technical Disclosures Bull.,* **3,** Jan. 1961, 23. Brief description of the production of Esaki junctions using boron-doped germanium.

519 **High-speed power driver circuit.** A. J. Gruodis, *IBM Technical Disclosures Bull.,* **3,** Jan. 1961, 27-28. Description of a transistor circuit providing an output current which follows the input signal rapidly and which has a low power dissipation.

520 **Hydraulics half-add binary numbers.** F. D. Ezekiel and R. J. Greenwood, *Control Engng.,* **8,** Feb. 1961, 145. Brief description of fluid logic element developed at M.I.T.

521 **An improved film cryotron and its application to digital computers.** V. L. Newhouse, J. W. Bremer and H. H. Edwards, *Proc. IRE,* **48,** Aug. 1960, 1395-1404. A crossed film cryotron deposited on an insulated superconductor is described and analysed. It has a time constant of less than one microsecond and is aproximately 100 times faster than the original crossed film cryotron. The d.c. dissipation is less than 5 μw., and the active area of each element is about 5×10^{-4} cm.^{2}. These cryotrons and all their interconnecting circuitry can be deposited at one time in a few simple steps. A cryotron storage circuit and a shift register are described. 9 refs.

522 **A magnetic associative memory system.** W. L. McDermid and H. E. Petersen, *IBM J. Res. & Dev.,* **5,** Jan. 1961, 59-62. Letter outlining research on the application of magnetic technology to associative memory systems (i.e. memories in which a data record is retrieved by specifying the information content of an arbitary portion of its structure). An experimental system for nondestructive readout of a magnetic core matrix system is described. 6 refs.

523 **Memory device.** J. K. Shortle, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 44. Brief description of a magnetic core device with extremely fast switching speed and comprising a toroidal body the major portion of which consists of low reluctance material such as iron, the flux path being completed by a segment of high reluctance material such as a square-loop ferrite.

524 **Memory element.** C. T. Marcy and E. D. Councill, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 51. Brief description of a multipath magnetic core device which is capable of one-dimensional write-in, i.e. with a single current.

525 **A new class of switching devices and logic elements.** P. R. McIsaac and I. Itzkan, *Proc. IRE,* **48,** July 1960, 1264-1271. This paper describes a new class of devices that perform switching and logic at microwave frequencies and employ electron beams and circuit elements closely related to those used in modern microwave tube technique. A preliminary device demonstrating the ability of a microwave signal to control a direct current is described, as is also an experimental travelling-wave interaction type tube which demonstrates the ability of one microwave signal to control another. 11 refs.

526 **The "Persistor"—a superconducting memory element.** E. C. Crittenden, J. N. Cooper and F. W. Schmidlin, *Proc. IRE,* **48,** July 1960, 1223-1246. Detailed account of the Persistor memory element, its properties, applications and production. The basic components of a Persistor are a superconducting inductor in parallel with a switch element which is normally superconducting, but which becomes resistive when the current exceeds a critical value. When a suitable current pulse is applied, a persistent circulating current is stored. A second pulse in the same direction causes no change, but a pulse in the opposite direction reverses the circulating current and produces a voltage across the element. By mutual inductance coupling to two or more driving circuits, Persistors can be made to operate in matrices. The elements are well suited to compact printed circuit production, with densities of a million per cubic foot possible. 5 refs.

527 **A sine function generator with high accuracy and resolution for analogue computers.** P. V. Venkatakrishnan, *J. Scientific & Ind. Res.*, **19B,** Oct. 1960, 371-374. A sine function generator using a small number of fixed, high-stability resistors and capable of giving the function as a direct voltage at 1 millicycle intervals is described. The function can be read out at any number of points simultaneously. An interpolation based on Taylor's expansion is used to obtain an intrinsic accuracy of ± 0.005 per cent. To realize this accuracy the component tolerances must be 0.002 per cent or better. A statistical analysis of the effect of component tolerances is presented which shows that with 0.1 per cent stability resistors an accuracy of 0.3 per cent full scale can be achieved. 7 refs.

528 **Storage device.** H. P. Wolff, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 45-46. Description of a multipath magnetic core which operates in response to sequentially applied pulses.

529 **Survey and classification of multiplying devices.** A. A. Maslov, *Automatika i Telemekhanika,* **21,** 1960, 1414-1432 (In Russian). English abstract: "The paper deals with systematisation of various principles of designing [analogue] multiplying devices in regard to the perspective of their further development in the direction of increasing their accuracy and high speed. . . ." 66 refs.

530 **Switching circuit.** J. J. Moyer, *IBM Technical Disclosures Bull.*, **3,** Jan. 1961, 20. Brief description of a high-speed switching circuit which checks parity and is composed of AND and OR gates.

531 **Theoretical current multiplication of a cylindrical hook collector.** D. P. Kennedy, *IBM J. Res. & Dev.*, **5,** Jan. 1961, 25-32. The current-multiplying hook collector is an integral part of most four-layer (PNPN) semiconductor switching devices. In this paper an analysis is given of the mechanisms of operation for a current-multiplying hook collector of cylindrical geometry. Equations are presented which establish the minority carrier transport efficiency within a cylindrical hook collector region; both surface and bulk recombination are assumed to be present. Also included in the analysis is the influence upon current multiplication of the factors determining minority carrier injection efficiency for a diffused hook emitter junction. Numerical evaluation of appropriate hook collector design equations are presented in graphical form throughout a range of geometrical parameters applicable to many practical situations. 17 refs.

532 **Thin-film cryotrons.** C. R. Smallman, A. E. Slade and M. L. Cohen, *Proc. IRE,* **48,** Sept. 1960, 1562-1582. This paper, which is concerned with the thin-film cryotron, is in three parts as follows :

Part I—Properties of thin superconducting films. C. R. Smallman, p. 1562-1568. Describes the characteristics of evaporated superconductive films as they apply to cryotrons.

Part II—Cryotron characteristics and circuit application, A. E. Slade, p. 1569-1576. The characteristics of the thin-film cryotron are described. The superconducting to normal transition in a tin gate 0·125 inch wide and 3×10^{-5} cm. thick is controlled by current in a single lead control, 0·006 inch wide, which crosses the gate. Silicon monoxide is used for insulation. The switching time of a cryotron circuit depends on the inductance and resistance, and inductance is reduced by using a superconductive ground plane and by reducing the length of all interconnecting leads. Nonlocking flip-flops have been constructed and a ring of 5 flip-flops have operated with a delay per stage of $\frac{1}{2}$ μsec.

Part III—An analysis of cryotron ring oscillators, M. L. Cohen, p. 1576-1582. This part presents two analyses, based on different ideal characteristics, of cryotron ring oscillators which have been constructed in order to study the dynamic behaviour of film cryotrons in circuits.

533 **A vacuum evaporated random access memory.** K. D. Broadbent, *Proc. IRE,* **48,** Oct. 1960, 1728-1731. Describes a basic multiple-layer magnetic thin film structure having special and desirable properties in coincident-signal switching applications such as those employed in binary random access memories. 6 refs.

534 **Wide-band operational amplifiers based on principle of cascade successive switching-off.** D. E. Polonnikov, *Automatika i Telemekhanika,* **21,** 1960, 1613-1622 (In Russian). English abstract: "There is proposed a principle of designing operational amplifiers which is based on cascade successive switching-off. The principle permits enlargement of the pass band by approximately two orders. Brief description of operational amplifiers of two types designed according to the proposed principle and the data of their test which confirm theoretical results are given." 7 refs.

535 **Computer-device applications of thin ferromagnetic films.** Remington Rand Univac Division, Sperry Rand Corp., *PB 150767,* May 1960, 30 p. This report describes the results of a study of the application of thin ferromagnetic films to computers. Anisotropic, "double threshold" and "rotating anisotropy" films were considered for use as logic and memory devices. A plausible explanation of the unique properties of double threshold and rotating anisotropy films is given in terms of domain walls and impurity atom diffusion. Two NDRO memory devices using double threshold and rotating anisotropy films are described. An AND gate, an EXCLUSIVE OR gate and three types of full adder using thin films are described.

536 **Instruction book. Typhoon resolvers 1, 2, 3, 4.** Moore School of Electrical Engineering, University of Pennsylvania, *PB 152651,* 1 April 1953, 47 p.

537 **An integrated binary adder.** M. E. Szekely, S. M. Marcus and J. T. Wallmark, David Sarnoff Research Center, *PB 152045,* 15 Aug. 1960, 20 p. This report describes an integrated full binary adder which uses as its active and passive elements unipolar field-effect transistors. 4 refs.

538 **Research in ferromagnetics.** Laboratory for Electronics Inc., *PB 149593,* 1959, 89 p. Experiments performed on two films of different iron-nickel composition show that a domain wall can be moved controlledly in a film made from a melt whose composition is in the vicinity of 80-20 Ni-Fe. The field required for domain wall nucleation is 25 per cent greater than the field to move a wall in a permalloy film. Equipment for making measurements of the properties of interest in the investigation of thin magnetic films is described. For a permalloy film it is shown that a Bloch to Néel transition occurs at about 250Å, independent of the film's anisotropy and that the wall energies are primarily by exchange and magnetostatic effects. The theory of these walls is applied to a coercive force calculation. The complex cross-tie wall is analysed. Three models introduced for calculation purposes are treated. The chain of ellipsoids model indicates that the origin of the wall lies in magnetostatic interactions, and the other two models attempt to show how the magnetic interaction produces the cross-tie. Several Bitter pattern experiments are examined. 20 refs.

539 **D.D.A. summation circuit.** A. V. Roe & Co., Ltd., *B.P. 857949,* 4 Jan. 1961. This patent describes a summation circuit for a digital differential analyser which employs two AND gates and an OR gate.

540 **Curve followed for analogue computer.** Gen. Electric Co., *B.P. 858002 & 858003,* 4 Jan. 1961. These two patents are concerned with an electronic curve follower which can be used in an analogue computer. An electron beam is focussed to a spot on a search surface on which the curve is displayed and the beam is deflected so as to move the spot in a small search circle.

541 **Magnetic core assembly.** Electric & Musical Industries Ltd., *B.P. 858279,* 11 Jan. 1961. In a magnetic core assembly for data storage or switching purposes, a conductor which passes through apertures in the cores comprises a multi-strand wire with strands connected together and to a current source so as to provide a multi-turn winding on each core in series with the source.

542 **Transistor trigger.** Electric & Musical Industries Ltd., *B.P. 858280,* 11 Jan. 1961. A trigger circuit includes a transistor with a transiently regenerative circuit whereby switching of another transistor can be affected with a waveform of smaller amplitude than otherwise possible.

543 **Magnetic core logic element.** Int. Business Machines Corp., *B.P. 858338,* 11 Jan. 1961. A logical element employs a single magnetic core with a sample winding through an aperture, an output winding on another part of the core and embracing at least one of inner and outer flux paths, and a reset winding embracing both flux paths.

544 **Magnetic memory device.** Nat. Research Development Corp., *B.P. 858762,* 18 Jan. 1961. A memory device comprises a magnetic block with a pair of parallel holes through which an energising loop is threaded, the spacing of the holes being such that for a given current a saturation field is produced throughout the space between the holes.

545 **Transistor shift register.** Metropolitan-Vickers Electrical Co., Ltd., *B.P. 858969,* 18 Jan. 1961. Each stage of a shift register comprises a bistable circuit formed by two cross-coupled transistors and the stages are coupled by delay circuits, each comprising a monostable circuit formed by two cross-coupled transistors.

546 **Data storage device.** Soc. d'Electronique et d'Automatisme, *B.P. 859004,* 18 Jan. 1961. This patent describes a data storage device in which electrical data signals are converted to a light pattern for application to a photoconductive layer associated with an electroluminescent layer, control being effected by optical control of the resistance condition of selected regions of a further photoconductive layer.

547 **Logic element.** Westinghouse Electric Corp., *B.P. 859306,* 18 Jan. 1961. A logic element is provided by a specified circuit arrangement of radiation-emitting devices (such as electroluminescent cells) and radiation-detecting devices (such as photoconductors).

548 **Magnetic core circuit for data storage.** Gen. Electric Co., *B.P. 859476,* 25 Jan. 1961. A data storage circuit comprises a magnetic core with an aperture providing two parallel magnetic paths, one only of which is magnetised by magnetic bias means, and specified windings arranged for non-destructive readout.

549 **Delay element.** Int. Computers & Tabulators Ltd., *B.P. 859565,* 25 Jan. 1961. Electrical signal delay apparatus which can be used for data storage, has an input transducer which launches a mechanical stress wave in a transmission medium, the wave repeatedly passing an output transducer without undergoing reversal of direction.

550 **Magnetic data storage device.** Standard Telephones & Cables Ltd., *B.P. 859704 & 859705,* 25 Jan. 1961. These two patents are concerned with a magnetic film data storage device. According to *B.P. 859704,* two single domain magnetic films are spaced one above the other with their oriented switching directions in line and conducting means are arranged to create a magnetic switching field both for writing and reading. According to *B.P. 859705,* a magnetic tube with a wall thickness not greater than 1/50th of its diameter is employed.

551 **Magnetic cores.** Int. Business Machines Corp., *B.P. 859751,* 25 Jan. 1961. A magnetic core storage device comprises a main magnetic circuit having two segments each divided into two flux paths, the paths of one segment being of unequal length and the two paths of the other segment forming a subsidiary magnetic circuit in which a biasing flux is established by a winding.

552 **Magnetic recording disc.** Int. Business Machines Corp., *B.P. 859833,* 25 Jan. 1961. A disc for the magnetic recording of data comprises a base member carrying, in addition to the magnetic coating, an annular screed whose surface is flush with the surface of the magnetic coating.

553 **Binary counter.** Monroe Calculating Machine Co., *B.P. 859934,* 25 Jan. 1961. This patent is concerned with a binary counting circuit in which a shift register has its input connected through an AND gate to a pulse generator and to a logical unit receiving signals according to the state of certain stages of the register.

554 **Adder.** Burroughs Corp., *U.S.P. 2947479,* 2 Aug. 1960. Addition is effected in an adder under control of adder gates, and thereafter the binary registration is converted to binary coded decimal registration under the control of decimal correction gates.

555 **Differentiator.** Hazeltine Research Inc., *U.S.P. 2947480,* 2 Aug. 1960. A voltage representing a function to be differentiated is applied periodically and instantaneously to a capacitor or other storage device, and the difference between the instantaneous value of that voltage and the voltage of the capacitor is utilised as a representation of the derivative of the function.

556 **Trigger circuit.** Int. Business Machines Corp., *U.S.P. 2947882,* 2 Aug. 1960. A trigger circuit comprises cross-coupled transistors in a circuit arrangement designed to prevent the transistors from becoming saturated.

557 **Analogue computing device.** D. H. Schaefer, *U.S.P. 2948473,* 9 Aug. 1960. A device producing an output voltage which is an analogue function of two input voltages, employs a magnetic core with rectangular hysteresis loop and PNP transistor or other switching means.

558 **Logical elements.** E. Goto, *U.S.P. 2948818 & 2948819,* 9 Aug. 1960. These two patents are concerned with circuits for performing logical operations which employ parametrically excited resonators or parametrons.

559 **Transistor multivibrators.** Radio Corp. of America, *U.S.P. 2948820,* 9 Aug. 1960. A circuit for an astable, monostable or bistable multivibrator with low power dissipation and relatively high output current, employs two cross-coupled pairs of transistors, the transistors of one pair being of one conductivity type, e.g. NPN, and those of the other pair being of another conductivity type, e.g. PNP.

560 **Function generator.** Gen. Precision Inc., *U.S.P. 2949233,* 16 Aug. 1960. A non-linear function of an independent variable is produced by supplying an input potential proportional to time rate of change of the variable to an electromechanical integrator and to a potentiometer which is adjusted by the integrator and has a characteristic corresponding to the derivative of the function, the output potential from the potentiometer being supplied to an electronic integrator which provides the desired output.

561 **Binary counter.** Gen. Dynamics Corp., *U.S.P. 2949542,* 16 Aug. 1960. A simple, scale-of-two counting circuit which employs a single magnetic core.

562 **Analogue integrator.** Hazeltine Research Inc., *U.S.P. 2950053,* 23 Aug. 1960. An electrical integrator with a relatively simple circuit in which a periodic voltage is compared with the sum of a voltage representing the function to be integrated and an integration voltage stored in a storage device, the sum being applied to the storage device when such comparison indicates equality.

563 **Function generator.** Gen. Precision Inc., *U.S.P. 2950399*, 23 Aug. 1960. An electronic function generator employing NPN and PNP transistors and which can be used to generate arc sine, arc cosine, sine and cosine functions.

564 **Shift register.** U.S. Secretary of the Navy, *U.S.P. 2950468*, 23 Aug. 1960. A shift register employing magnetic cores with input, output and shift windings on each core, the shift windings being serially connected as part of an electronic delay line with capacitive shunt elements.

565 **Magnetic core matrix.** Bell Telephone Labs., Inc., *U.S.P. 2951240*, 30 Aug. 1960. A word-organised magnetic core matrix has circuit arrangements designed to reduce the read-out and write-in time.

566 **Magnetic data storage device.** Int. Business Machines Corp., *U.S.P. 2951241*, 30 Aug. 1960. A magnetic device for storing pulses, comprises a magnetisable member including magnetisable particles having different resonant frequencies and which are magnetically saturated. Different demagnetising frequencies are selectively impressed on the particles and differences in the remanent magnetisation of the particles are sensed.

See also :—
Design, Ref. 426, 430, 440.

ANALOGUE

567 **PACIT, a small-budget expandible precision analog computer.** F. P. Green, *Ann. Assn. Int. Calcul Analogique*, **3,** Jan. 1961, 6-10. Description of PACIT, an analogue computer constructed in Finland, particularly for use in nuclear reactor kinetics studies. Unit-package design and other provisions make the 12 amplifier computer readily expandible to a 24 amplifier computer with corresponding expansion in non-linear components. A detailed enumeration of the design criteria used to guide the construction of PACIT is presented. A general description of the console is accompanied by details of several control, safety and flexibility features. 3 refs.

568 **Where can analog computers be used?** J. H. Bredberg, *International Electronics*, **1,** Jan. 1961. 50, 52. Brief, general account of areas of application of analogue computers.

569 **An analog correlation computer.** C. E. McCullough, University of Texas, *PB 150649*, 1 Aug. 1960, 57 p. This report describes a correlation computer designed to be compatible with the equipment which is presently being used for data handling. The computer obtains its input from magnetic tape, and since the time functions to be analysed are recorded directly on magnetic tape, correlation analyses may be performed using a minimum of manual or automatic transcription processes. Time functions from a few seconds to several hours in length may be analysed. Included also is a discussion of the theory involved in correlation analysis, a description of the operation of the computer, and several examples of auto-correlation and cross-correlation analyses which have been performed with the computer. 12 refs.

570 **Special purpose analagoue computer.** R. Levi, *B.P. 858707*, 11 Jan. 1961. This patent is concerned with an analogue computer for solving problems of distribution of articles between production and consumption centres with minimum transport costs. The production and consumption centres are each represented by a matrix of conductors and variable voltages are applied to represent the numbers of articles available or required at the different centres.

DIGITAL

571 **Polymorphic.** *Data Processing* (London) **3,** Jan.-March 1961, 22-27. General description of the Ramo-Wooldridge RW-400 data processing system and its "polymorphic" organisation which enables several programs to be run concurrently and makes it more flexible than a conventional computer.

572 **Remrand announces 'third generation' 1107.** H. R. J. Grosch, *Datamation*, **7,** Jan. 1961, 42. Description of the use made of thin magnetic films in the UNIVAC 1107 scientific computing system.

573 **Survey of digital computer and calculator users and orders (11).** D. G. Pedder and R. Pedder, *Automn. & Auto. Equipment News*, **6,** Jan. 1961, 240-261. This quarterly cumulative survey comprises tabulated details of British computer manufacturers' deliveries and orders.

574 **Digital computer.** L. E. Coste, *G.P. 1094489*, 8 Dec. 1960. This patent is concerned with a digital computer employing algebraic quinary representation, each digit being represented by a group of four signals.

575 **Digital computer.** Int. Business Machines Corp., *U.S.P. 2947478*, 2 Aug. 1960. This patent is concerned with a digital computer having improved flexibility of control with respect to decimal point operation. Radix point representations can be erasably recorded in selected orders of a pair of registers which coact to perform a mathematical function, and if the position of the point representation is changed in one register, a corresponding change is made in the other register.

PROGRAMMING

576 **Competitive programming.** V. B. Thompson, *Data Processing* (Detroit), **3,** Jan. 1961, 24. Description of how three programmers prepared a payroll program for the IBM 650. The program was divided into subroutines and each subroutine was programmed by all the programmers on a competitive basis; in each case the fastest subroutine was incorporated into the program.

577 **Running Pegasus Autocode programs on Mercury.** A. Gibbons, *Computer J.*, **3,** Jan. 1961, 232-236. The problems of simulating Pegasus Autocode on Mercury are discussed and the use of a new general method of translating autocodes suggested by R. A. Brooker (see Ref. 578) for translating Pegasus Autocode programs into Mercury machine code is described. The specification of the Mercury program, Pegasus Autocode Input Routine, is given. 2 refs.

578 **Some proposals for the realization of a certain assembly program.** R. A. Brooker and D. Morris, *Computer J.*, **3,** Jan. 1961, 220-231. This paper describes proposals for a method of implementing the scheme which is described by the authors in "An assembly program for a phrase structure language", *ibid*, **3,** Oct. 1960, 168-174 (*C.A.*, **4,** Dec. 1960, Ref. 2448). The particular feature of this assembly program, which it is hoped to develop for Atlas, is that it permits the user to define the meaning of the statements he uses.

579 **Application of Boolean matrices to the analysis of flow diagrams.** R. T. Prosser, M.I.T., *PB 150599*, 22 Jan. 1960, 11 p. An analysis of the structure of flow diagrams such as those associated with computer programs, can be given in terms of Boolean matrices. A pair of Boolean matrices is associated with each diagram. The first of these, called the connectivity matrix, contains the topological structure of the diagram and the second, called the precedence matrix, contains its precedence relations. Elementary computations on these matrices are shown to yield detailed information concerning the internal logical consistency of the flow diagram. Possible applications to automatic compiling and debugging procedures are suggested. 15 refs.

580 **PERT: Program Evaluation and Review Technique for the Royal McBee LGP-30 computer.** Army Chemical Corps Engineering Command, Army Chemical Center, Maryland, *PB 150992*, July 1960, 90 p. This report gives the results of a study undertaken to convert the Booz-Allen-Hamilton Program Evaluation and Review Technique (PERT) for small scale applications to the Royal McBee LGP-30. The report contains presentations on the program function and capabilities, operating instructions, LGP-30 flow chart, symbolic and machine language codes, data input error check list, data tables and LGP-30 subroutine and data table assembly.

APPLICATIONS

AERONAUTICAL

581 **New computing facility combines analog and digital techniques.** H. Levy, *Datamation*, **7,** Jan. 1961, 44-46. Account of an integrated analogue and digital system for providing statistical information concerning manoeuvre loads which will be used to establish realistic load criteria for the design of aircraft and components, and which is a joint project of the National Aeronautics and Space Administration, U.S. Air Force and U.S. Navy. The system is designed to process the analogue values of impact pressure, static pressure, normal load factor, transverse load factor, longitudinal load factor, yawing angular velocity, rolling angular velocity, and pitching angular velocity. These values are recorded on metal tape by a special flight recorder system and a master analogue tape is then produced by an Ampex FR614 tape unit for reading into a Beckman EASE Analog Computer. This computer produces 19 quantities, namely equivalent air speed, pressure altitude, mach number, stagnation temperature, the load factors corrected to the centre of gravity, the effective normal load factor, the three angular velocities and their derivatives, the roll angular displacement, the helix angle and three cross coupling factors. These quantities are converted to digital form by a Beckman Model 210 Data System and recorded on magnetic tape by an IBM 729-II. Statistical analyses are then performed on a Control Data Corporation 1604 digital computer. An IBM 1401 is provided for editing and preliminary screening purposes.

582 **Trajectory of a vehicle departing from a circular orbit.** R. B. Bowersox and D. Carter, Lockheed Aircraft Corp., *PB 150886,* July 1960, 41 p. Numerical solutions for the two-body equations of motion have been obtained by means of a digital computer for the case of a rocket departing from an initial circular orbit with constant thrust and flow rate. Thirty solutions have been obtained in a wide range of thrust amplitudes, specific impulses and thrust directions. One solution was obtained for an initial elliptical orbit and another for a small negative thrust as might be used in a landing manoeuvre. The circular orbit appears to possess a special stability when it is being expanded, but the opposite is true for negative thrust, in which case the trajectory becomes very eccentric. 10 refs.

BUSINESS

583 **Administering 625,000 industrial life insurance policies by computer.** *Data Processing* (London), **3,** Jan.-March 1961, 10-21. Account of how the Swedish Trygg-Fylgia group of insurance companies make use of a Ferranti Perseus.

584 **Predicting distributions of staff.** A. Young and G. Almond, *Computer J.*, **3,** Jan. 1961, 246-250. This paper describes a method of predicting the number and distribution of staff among various grades in future years and shows how future trends can be determined mathematically when recruitment and promotion patterns are stable. 1 ref.

See also :—
Analogue, Ref. 570.

CONTROL—GENERAL SYSTEMS

585 **On control of linear systems with time lags.** J. D. R. Kramer, *Information & Control,* **3,** Dec. 1960, 299-326. In this paper, the terminal control of a general time invariant linear system with time lags is studied in a variety of situations by means of the optimisation technique of dynamic programming. Optimum control law satisfying a minimum energy constraint are explicitly derived under each of the following assumptions concerning the noise in the system: noise free, noise generated by a Markov source, noise whose statistics are partially unknown, and worst case or competitive disturbances. 12 refs.

586 **Information systems in control engineering.** E. J. Kompass, *Control Engng.*, **8,** Jan. 1961, 103-105. Introduction to information systems in control systems and to a new section of *Control Engng.* devoted to articles on new techniques, equipment, applications and principles in the generalised areas of data gathering, data transmission and storage, data reduction and processing and information presentation. 5 refs.

587 **Operating mode automatic optimization based on statistical control criteria.** S. A. Doganovskii, *Automatika i Telemekhanika,* **21,** 1960, 1105-1114 (In Russian). English abstract: "There is considered operating mode automatic optimisation in a class of systems which are under random disturbance action. Design of a computer device based on present control criteria is outlined. Results of the investigation of optimisation process are given." 9 refs.

CONTROL—MACHINE TOOL

588 **New continuous path system uses DDA interpolator.** H. B. Henegar, *Control Engng.*, **8,** Jan. 1961, 71-76. Description of the Bendix Dynapath continuous path machine tool control system. A major feature of the system is the ability to perform both linear and circular interpolation, the interpolator being a serial binary digital differential analyser with magnetostrictive delay lines for dynamic storage. Circular interpolating ability adds two advantages: computer time required for tape preparation is reduced since the need for approximating circular arcs with small straight line segments is eliminated; and parts consisting of arcs of circles and straight lines can be programmed without computer assistance. 2 refs.

See also :—
General, Ref. 412.

CONTROL—PRODUCTION AND PROCESS

589 **Computers in process control.** M. B. Wood, *Control,* **4,** Feb. 1961, 94-97. This article discusses the requirements of a digital computer designed for process control and the ways in which the computer can fulfil them. The main requirements considered are extremely high standards of reliability; facilities for accepting information from many different channels; adequate computation speed; internal time-monitoring facilities; simplicity and low cost; and sound mechanical and electrical design.

590 **Job shop production control on a computer.** M. Reid, *Control Engng.*, **8,** Jan. 1961, 107-110. Description of how Bell Helicopter Company have brought all major manufacturing record and control systems into one functional organisation employing an IBM 650 (to be replaced later by an IBM 1401).

591 **Algorithms for solving production-scheduling problems.** B. Giffler and G. L. Thompson, *Operations Research,* **8,** July-Aug. 1960, 487-503. Algorithms are developed for solving problems to minimise the length of production schedules. The algorithms generate any one, or all, schedules of a particular subset of all possible schedules, called the active schedules. This subset contains, in turn, a subset of the optimal schedules. It is shown that every optimal schedule is equivalent to an active optimal schedule. Computational experience with the algorithms on an IBM 704 shows that it is practical, in problems of small size, to generate the complete set of all active schedules and to pick the optimal schedules directly from this set and, when this is not practical, to random sample from the set of all active schedules and, thus, to produce schedules that are optimal with a probability as close to unity as is desired. The basic algorithm can also generate the particular schedules produced by well-known machine loading rules. 7 refs.

592 **Computer production control—the second year.** D. J. L. Hughes, *Computer J.*, **3,** Jan. 1961, 198-201. Describes improvements made in the production control scheme using an ICT 1201 at I.C.T.'s Letchworth factory and plans for extending it to several larger factories where ICT 1202's will be used. 1 ref.

See also :—
General, Ref. 412.

ELECTRONICS

593 **Antenna pattern simulation on the analog computer.** T. L. Gunn, *Proc. IRE,* **48,** Nov. 1960, 1916. Letter briefly describing an analogue computer scheme for antenna power spectrum simulation which allows complete generality on the amplitude and phase functions across the antenna aperture. 2 refs.

594 **Methods of analysis of circuit transient performance.** L. Hellerman and E. J. Skiko, *IBM J. Res. & Dev.*, **5,** Jan. 1961, 33-43. This paper surveys some numerical methods applicable in obtaining the distribution of performance parameters associated with the transient behaviour of switching circuits. The methods considered are: (1) Monte Carlo, in which sample circuits are simulated on the IBM 704 and their performance computed and tabulated. (2) Parameter sensitivity methods, including propagation of error, in which the first and second moments of the output distribution are estimated from parameter sensitivities; and a method using the total differential of the performance parameter to estimate the deviation of circuit behaviour from its component deviations. (3) A surface fitting method, in which there is developed a formula for delay time in terms of circuit component values. Each method is used to determine the delay time of a simple system. Their merits and drawbacks are compared and discussed, and estimates are given of the IBM 704 machine time necessary for implementation on a ten-transistor switching circuit. 17 refs.

595 **Study of semiconductor devices by analogue techniques.** R. Bharat, Stanford University, *PB 150525,* 16 Nov. 1959, 91 p. Analogue techniques are applied to the study of semiconductor devices in pulse circuits, enabling a transient analysis to be made of models which describe both the internal and the terminal behaviour of the devices. Physical phenomena in semiconductor devices are described in terms of lumped models and an analogue computer is set up to simulate the equations derived from these models. Equations relating the variables in the model of the device to the variables describing the circuit in which the device is operating are also simulated on the computer, and transient solutions are obtained for all the variables. Computer and electric circuit analogues of several physical phenomena encountered in semiconductor devices are developed. Both linear and nonlinear phenomena are considered and various methods of simulating them are described. Analogue computer solutions are obtained for transistor pulse circuits in which interacting nolinear phenomena influence the operation of the circuit. Solutions for a drift-transistor switching circuit and for an avalanche-transistor relaxation oscillator are presented. 16 refs.

ENGINEERING, ELECTRICAL

596 **Method of calculating the economical distribution of active loads in a power system utlizing digital computers.** N. A. Kachanova and V. V. Umedyan, *Automatika,* 1959, No. 4, 63-71 (In Russian). English abstract: "The authors offer a method of calculating the economical distribution of active loads among the thermal power stations of a system, utilising digital computers for this purpose. The most universal method of calculating the losses in the network is the one where some of the loads having a graph which does not coincide with that of the summed load of the system are accounted in accordance with the actual given load on concrete substations; the other loads are accounted in the total balance of power in the system, in order to facilitate the task." 6 refs.

INFORMATION RETRIEVAL

597 **Correspondence.** M. M. Berlin, *Computer J.,* **3,** Jan. 1961, 210. Brief letter stating that the writer has used a technique similar to that described in "Prime number coding for information retrieval", A. H. Cockayne and E. Hyde, *ibid,* **3,** April 1960, 21-22 (*C.A.,* **4,** June 1960, Ref. 1052).

598 **A computer analysis of the Merck Sharp and Dohme indexing system.** C. K. Schult and C. A. Shepherd, Remington Rand Univac Division, Sperry Rand Corp., *PB 150819,* 1959, 37 p.

NUCLEAR

599 **Simulatore analogico per lo studio di impianti nucleari** (Analogue simulator for the study of nuclear power plants). G. Ambrosini, S. Barabaschi and L. Gentilini, *Automazione e Strumentazione,* **8,** June 1960, 251-261 (In Italian). After some remarks on the use and importance of analogue computers in the study of nuclear plants, a description is given of a simulator constructed in the Servo Controls Laboratory of the C.N.R.N. Nuclear Research Centre at Ispra. The simulator is composed of a general purpose analogue computer and some special circuits for simulating such blocks as vary very little from one nuclear plant to another or are difficult to simulate on a general purpose computer. 5 refs.

600 **An analogue computer for the generalized three-compartment model of transport in biological systems.** E. C. Gregg, Western Reserve University, *NYO-2096,* Dec. 1959, 25 p.

601 **Computer techniques for radioactivation analysis, annual report.** W. E. Kuykendall and R. E. Wainerdi, Texas Engineering Experiment Station, *ORO-307,* May 1960, 200 p.

See also :—
Analogue, Ref. 567.

PHYSICS

602 **Exclusively to design lenses.** *Auto. Data Processing,* **3,** Jan. 1961, 16-18. General account of lens designing with a National-Elliott 402 by Taylor, Taylor and Hobson Ltd.

603 **Stability criteria for numerical solutions of the normal and shock regions in unsteady two-dimensional cylindrical Lagrangian flow.** J. W. Enig, Naval Ordnance Lab., White Oak, Maryland, *PB 148178,* 15 March 1960, 17 p. An application of a method given by von Neumann and Richtmyer is used to derive the stability criteria for numerical solutions of the normal and shock regions in unsteady two-dimensional cylindrical Lagrangian flow. The shocks are computed by the pseudo-viscosity method for one-dimensional flow; this method has been applied to the computation of unsteady shock propagation in two-dimensions. By introducing a small perturbation into the hydrodynamic differential equations, the set of equations of first variation are obtained. The stability criteria are obtained by performing a stability analysis on the finite difference representation of the dominant equation of the set of equations of first variation. Utilisation in programs shows that the derived criteria lead to stable solutions. 4 refs.

604 **Potential flow about bodies of revolution and symmetric two-dimensional forms.** L. Landweber, Iowa Inst. of Hydraulic Research, *PB 152099,* Dec. 1959, 68 p. A procedure is presented for computing the potential flow about bodies of revolution and symmetric two-dimensional forms in arbitary states of motion. Solution for general motion is obtained by superimposing the solutions of the boundary value problems for the different components. Technique consists of formulating each problem as a Fredholm integral equation of the first kind which can be closely approximated, by means of a quadrature formula of moderate order, by a set of linear equations with a matrix having a strong principal diagonal, suitable for solution either by elimination or iteration. For the general motion of bodies of revolution, three such integral equations need to be solved; for the two-dimensional forms, solutions for four potential flow problems are required, two of which are obtained from integral equations, the remaining two being obtained from the integral equation solution for longitudinal flow by conformal mapping. The method was programmed for the IBM 650. The separate programs for the body of revolution and two-dimensional forms are presented and the application of computer-obtained results is illustrated with several examples. A shorter, less accurate, non-computer procedure is illustrated and compared with the computer-obtained results. 13 refs.

605 **General equation for terminal velocity of free-falling spherical drops for solution on an electronic computer.** F. A. Hedman and R. L. Campbell, Army Chemical Research and Development Labs., Army Chemical Center, Maryland, *PB 150100,* July 1960, 14 p. An empirical equation, easily differentiated and suitable for use with computers, has been derived to give the terminal velocities of spherical drops having diameters in the range of 3μ to more than 5500μ. The derivation of the equation made use of equations by Stokes and Newton. 5 refs.

SIMULATION

606 **Simulation of air operations with the Air-Battle Model.** R. H. Adams and J. L. Jenkins, *Operations Research,* **8,** Sept.-Oct. 1960, 600-615. This paper is concerned with the Air-Battle Model, a device for simulating a large-scale two-sided global war on a digital computer (an IBM 709 is being used at present). The Air-Battle Model System consists of (1) the Plan Converter which provides mechanised conversion of U.S. Air Force operational plans into the proper form for model input; (2) the Air-Battle Model, consisting of a master control routine and seven major routines for simulation of missile launching, bomber launching, tanker operations, bomber cell handling, attrition by enemy defences, target selection and reconnaissance, and blast damage and radiation effects; and (3) the Output Programs which sort, compile and tabulate the detailed histories of all offensive and defensive bases, and all operations simulated in each model run.

607 **Simulation Council Newsletter.** J. H. McLeod (Ed.), *Instr. & Control Systems,* **34,** Jan. 1961, 75-77, 79, 80. Consists mainly of summaries of talks given at the Western Simulation Council Meeting of 22 July 1960 on "Mathematical models of the circulatory and respiratory system" by E. Deland, "Comments on computer simulation of physiological processes" by G. Bekey and J. H. McLeod, and "Problems in human simulators: the heart-lung machine", by J. V. Maloney.

TRANSPORT

608 **An improved transportation movement system overseas.** H. J. Canty, J. O. Carter et al., Stanford University, *PB 150612*, July 1960, 244 p. This report presents a proposed improved system for transportation movements of personnel and cargo in an overseas area, highway traffic regulation and control, and budgeting and accounting for transportation movements. One portion of the report describes a complete manual system, while a subsequent section deals with the application of automatic data processing to such a system.

609 **Programming IBM 650 RAMAC computer for data processing in an air route traffic control center.** H. R. Johnson, J. E. Erikson et al., National Aviation Facilities Experimental Center, *PB 171040*, Oct. 1959, 105 p. This report describes the development and preparation of a detailed air traffic control program for an IBM 650 RAMAC system. Many portions of the program are predicated on the ability of this system to process all of the many types of flight plan information, to produce flight progress strips, and furnish other information needed for the control of air traffic at the Indianapolis Air Route Traffic Control Center. A description is given of the types and quantities of flight plans which must be processed. A general discussion of the program logic used for processing airway and/or direct route flight plans is included and is illustrated by charts, flow diagrams and pictures. 2 refs.

MISCELLANEOUS

610 **Analyzing election computing 1960.** *Datamation*, **7**, Jan. 1961, 35-36. General discussion of results obtained with IBM 7090 and RAMAC, RCA 501 and Univac I in predicting the results of the 1960 American Presidential Elections. More detailed analyses of the three projects are given in the articles abstracted below in Refs. 611 to 613.

611 **RCA NBC.** S. I. Newrith, *Datamation*, **7**, Jan. 1961, 36-37. General account of the methods and equipment used by the Radio Corporation of America and its National Broadcasting Company Division to predict the results of the 1960 American Presidential Election with an RCA 501.

612 **IBM CBS.** G. T. Hunter, *Datamation*, **7**, Jan. 1961, 38-39. General account of the methods and equipment used by IBM to predict on CBS television the results of the 1960 American Presidential Election with an IBM 7090 and IBM 305 RAMAC.

613 **Remrand ABC.** M. A. Woodbury, *Datamation*, **7**, Jan. 1961, 39-40. Brief account of the results obtained with a Univac I in predicting on ABC television the outcome of the 1960 American Presidential Election.

614 **On the efficiency of a new method of dictionary construction.** A. D. Booth and A. J. T. Colin, *Information & Control*, **3**, Dec. 1960, 327-334. This paper presents a method of constructing dictionaries of texts which is specifically designed for digital computers. The method is based on a logical tree structure and has advantages in compilation and use over alphabetical storage of words (as in the manual method) and storage of words in the order in which they occur. 2 refs.

615 **Techniques for producing school timetables on a computer and their application to other scheduling problems.** J. S. Appleby, D. V. Blake and E. A. Newman, *Computer J.*, **3**, Jan. 1961, 237-245. Possible methods of producing school timetables on a digital computer are discussed. Two programs which have been run respectively on DEUCE and ACE are described and discussed. A third, more comprehensive program which has not yet been run is briefly described. The authors consider that the most important aspect of the work is in finding out how to use computers for this type of logical work, and the relationship of school timetable preparation to other scheduling problems such as factory work-load scheduling and air traffic control is briefly discussed.

616 **Analog computer computation of propellant linear burning rate.** A. I. Rubin, Picatinny Arsenal, Dover, New Jersey, *PB 152351*, March 1956, 33 p. Special circuitry was developed to compute linear burning rate from closed bomb data with the EASE analogue computer. Details of the computation are given for a representative problem. 3 refs.

617 **An analytical system for interpolation and calculation of dynamic heights.** R. E. Kilmer and A. C. Duxbury, Texas A. and M. College, *PB 150487*, Nov. 1959, 35 p. This report is concerned with a data processing system designed to provide a rapid procedure for the computation and evaluation of hydrographic data. The method is functional and accurate. The computer calculations are completely objective and any variations in the interpolated curves which do not meet the approval of the classical oceanographer may be changed at the discretion of the investigator. 4 refs.

618 **Design and operation of the ceilometer computer.** P. Meissner, National Bureau of Standards, *PB 161565*, Oct. 1960, 77 p. The ceilometer computer has been developed to provide a display and electrical readout of cloud height information for use with an automatic weather station. The computer receives an analogue signal from the detector of a rotating-beam ceilometer and determines the height at which cloud indications occur. A small magnetic drum stores ten minutes of cloud height information which is continuously updated, and this data is analysed for the following factors: predominant cloud height over the last ten minutes; maximum and minimum height at which significant cloud occurrences were observed; and number of cloud observations up to a selected critical altitude. The computer is a wired-program machine constructed of transistorised plug-in packages.

BOOKS

619 **Automation cybernetics and society.** F. H. George, Leonard Hill (Books) Ltd., 1961, £1. 15. 0. This book gives an overall picture of cybernetics and its application as automation. It is not intended for specialists in any field for it is primarily aimed to clarify the problem of the social impact of these subjects not only for the scientists, but for the executives and the layman. Contents: The argument; Science and common sense; The nature of science; Automation; Cybernetics; Communication theory; Signs, language, and communication; Logic and machines; Computers and computations; Servo-systems; Cybernetics and Psychology; Cybernetics and physiology; The philosophical problem of the machine; Organisms, models, and feedback; Programming a computer to learn; Social science, anthropology and the machine; Methods of the psychologist in the age of automation; Social control and communication; Operational research and scientific method; The future of automation; The automatic factory; The future of civilization.

620 **Programming for digital computers.** J. F. Davison, Business Publications Ltd., 1961, 186 p., £1. 15. 0. An introduction to the writing of programs, intended for those taking up programming and those who work closely with programmers, such as business system analysts. Problems encountered are first described in general terms and then considered in detail in relation to an imaginary computer. Programming techniques are discussed up to the point of showing why automatic coding is desirable and indicating how it can be done. Examples of parts of programs relating to both technical calculations and business data processing are given. Contents: Introduction to computers; The role of the programmer; The programmer's task; Details of programming; Further programming facilities; More sophisticated programming techniques, Interpretive schemes and autocodes; Variations in computers and peripheral equipment.